# CLAIMS

**WHAT IS CLAIMED IS:**

1. A method of controlling a conductive layer deposition process, comprising:

depositing a conductive layer above a first semiconductor wafer based upon a deposition recipe;

measuring a thickness of the conductive layer deposited on the semiconductor wafer;

determining whether the measured thickness of the conductive layer is within a predetermined tolerance; and

revising the deposition recipe if the measured thickness of the conductive layer is not within the predetermined tolerance.

2. A method, according to claim 1, wherein:

depositing the conductive layer above the first semiconductor wafer further comprises depositing a copper layer above the first semiconductor wafer;

measuring the thickness of the conductive layer further comprises measuring the thickness of the copper layer;

determining whether the measured thickness of the conductive layer is within the predetermined tolerance further comprises determining whether the measured thickness of the copper layer is within the predetermined tolerance; and

revising the deposition recipe further comprises revising the deposition recipe if the measured thickness of the copper layer is not within the predetermined tolerance.

3. A method, according to claim 1, wherein revising the deposition recipe further comprises revising at least one parameter selected from the group consisting of an electroplating bath temperature, a chemical concentration of an electroplating

bath, an anode-cathode spacing, an anode power setting and an electroplating deposition time.

4. A method, according to claim 1, further comprising depositing a conductive layer above a second semiconductor wafer based upon the revised deposition recipe.

5. A method, according to claim 1, wherein revising the deposition recipe further comprises revising the deposition recipe according to at least one predetermined model.

6. A method of controlling a conductive layer deposition process, comprising:

depositing a conductive layer above a first semiconductor wafer based upon a deposition recipe;

measuring a thickness of the conductive layer at a plurality of locations;

calculating a value representing the measured thickness measured at the plurality of locations;

determining whether the calculated value is within a predetermined tolerance; and

revising the deposition recipe based upon at least the calculated value if the calculated value is not within the predetermined tolerance.

7. A method, according to claim 6, wherein:

depositing the conductive layer above the first semiconductor wafer further comprises depositing a copper layer above the first semiconductor wafer; and

measuring the thickness of the conductive layer further comprises measuring the thickness of the copper layer at the plurality of locations.

8. A method, according to claim 6, wherein measuring the thickness of the conductive layer further comprises measuring the thickness of the conductive layer in a predetermined pattern of locations.

9. A method, according to claim 6, wherein calculating the value further comprises calculating an average of the plurality of thickness measurements.

10. A method, according to claim 6, wherein calculating the value further comprises calculating the value selected from the group consisting of an arithmetic mean of the plurality of thickness measurements, a median of the plurality of thickness measurements, a mode of the plurality of thickness measurements, a geometric mean of the plurality of thickness measurements, a harmonic mean of the plurality of thickness measurements, and a quadratic mean of the plurality of thickness measurements.

11. A method according to claim 6, wherein determining whether the thickness of the conductive layer is within the predetermined tolerance further comprises calculating a measure of a degree of dispersion of the plurality of thickness measurements about the calculated value and comparing the measure of the degree of dispersion to a predetermined statistical distribution.

12. A method, according to claim 6, wherein determining whether the thickness of the conductive layer is within the predetermined tolerance further comprises calculating a measure of a degree of dispersion of the plurality of thickness measurements about the calculated value representing the measured thicknesses and comparing the measure of the degree of dispersion to a distribution selected from the group consisting of a normal distribution, a binomial distribution, a Poisson distribution, and a multinomial distribution.

13. A method, according to claim 6, wherein revising the deposition recipe further comprises revising the deposition recipe according to at least one predetermined model.

14. A method, according to claim 6, wherein revising the deposition recipe further comprises revising at least one parameter selected from the group consisting of an electroplating bath temperature, a chemical concentration of an electroplating

bath, an anode-cathode spacing, an anode power setting and an electroplating deposition time.

15. A method, according to claim 6, further comprising depositing a conductive layer above a second semiconductor wafer based upon the revised deposition recipe.

16. An apparatus, comprising:

a deposition unit capable of depositing a conductive layer above a semiconductor wafer according to a deposition recipe;

a thickness measuring unit capable of measuring a thickness of the conductive layer and outputting thickness data; and

a deposition control unit capable of receiving the thickness data from the thickness measuring unit, determining whether the thickness data is within a predetermined tolerance, revising the deposition recipe if the thickness data is not within the predetermined tolerance, and outputting the revised deposition recipe,

wherein the deposition unit is capable of receiving the revised deposition recipe from the deposition control unit.

17. An apparatus, according to claim 16, wherein the deposition is capable of depositing a copper layer above the semiconductor wafer according to the deposition recipe and the thickness measuring unit is capable of measuring a thickness of the copper layer and outputting the thickness data.

18. An apparatus, according to claim 16, wherein the deposition control unit is capable of calculating deposition bias information and outputting the calculated deposition bias information, wherein the deposition unit is capable of receiving the calculated deposition bias information.

19. An apparatus, according to claim 16, further comprising a supervisory control unit capable of controlling overall system manufacturing, receiving the revised deposition recipe, and outputting the revised deposition recipe, wherein the

deposition control unit is capable of receiving the revised deposition recipe from the supervisory control unit.

20. An apparatus, according to claim 19, wherein the deposition control unit is capable of calculating deposition bias information and outputting the calculated deposition bias information, wherein the supervisory control unit is capable of receiving the calculated deposition bias information.

21. An apparatus, according to claim 19, further comprising a system communication bus interconnected with and capable of carrying information between the deposition unit, the thickness measuring unit, the deposition control unit, and the supervisory control unit.

22. An apparatus, comprising:

means for depositing a conductive layer above a first semiconductor wafer based upon a deposition recipe;

means for measuring a thickness of the conductive layer deposited on the semiconductor wafer;

means for determining whether the measured thickness of the conductive layer is within a predetermined tolerance; and

means for revising the deposition recipe if the measured thickness of the conductive layer is not within the predetermined tolerance.

23. An apparatus, according to claim 22, wherein:

the means for depositing the conductive layer above the first semiconductor wafer further comprises means for depositing a copper layer above the first semiconductor layer;

the means for measuring the thickness of the conductive layer further comprises means for measuring the thickness of the copper layer;

the means for determining whether the measured thickness of the conductive layer is within the predetermined tolerance further comprises means for determining whether the measured thickness of the copper layer is within the predetermined tolerance; and

the means for revising the deposition recipe further comprises means for revising the deposition recipe if the measured thickness of the copper layer is not within the predetermined tolerance.

24. An apparatus, according to claim 22, wherein the means for revising the deposition recipe further comprises means for revising at least one parameter selected from the group consisting of an electroplating bath temperature, a chemical concentration of an electroplating bath, an anode-cathode spacing, an anode power setting and an electroplating deposition time.

25. An apparatus, according to claim 22, further comprising means for depositing a conductive layer above a second semiconductor wafer based upon the revised deposition recipe.

26. An apparatus, according to claim 22, wherein the means for revising the deposition recipe further comprises means for revising the deposition recipe according to at least one predetermined model.

27. An apparatus, comprising:

means for depositing a conductive layer above a first semiconductor wafer based upon a deposition recipe;

means for measuring a thickness of the conductive layer at a plurality of locations;

means for calculating a value representing the plurality of thickness measurements;

means for determining whether the calculated value is within a predetermined tolerance; and

means for revising the deposition recipe if the calculated value is not within the predetermined tolerance.

28. An apparatus, according to claim 27, wherein:

the means for depositing the conductive layer above the first semiconductor wafer further comprises means for depositing a copper layer above the first semiconductor wafer; and

the means for measuring the thickness of the conductive layer further comprises means for measuring the thickness of the copper layer at the plurality of locations.

29. An apparatus, according to claim 27, wherein the means for measuring the thickness of the conductive layer further comprises means for measuring the thickness of the conductive layer in a predetermined pattern of locations.

30. An apparatus, according to claim 27, wherein the means for calculating the value further comprises means for calculating an average of the plurality of thickness measurements.

31. An apparatus, according to claim 27, wherein the means for calculating the value further comprises means for calculating the value selected from the group consisting of an arithmetic mean of the plurality of thickness measurements, a median of the plurality of thickness measurements, a mode of the plurality of thickness measurements, a geometric mean of the plurality of thickness measurements, a harmonic mean of the plurality of thickness measurements, and a quadratic mean of the plurality of thickness measurements.

32. An apparatus, according to claim 27, wherein the means for determining whether the thickness of the conductive layer is within the predetermined tolerance further comprises means for calculating a measure of a degree of dispersion of the plurality of thickness measurements about the calculated value representing the plurality of thickness measurements and comparing the measure of the degree of dispersion to a predetermined statistical distribution.

33. An apparatus, according to claim 27, wherein the means for determining whether the thickness of the conductive layer is within the predetermined tolerance further comprises means for calculating a measure of a

degree of dispersion of the plurality of thickness measurements about the calculated value representing the plurality of thickness measurements and comparing the measure of the degree of dispersion to a distribution selected from the group consisting of a normal distribution, a binomial distribution, a Poisson distribution, and a multinomial distribution.

34. An apparatus, according to claim 27, wherein the means for revising the deposition recipe further comprises means for revising the deposition recipe according to at least one predetermined model.

35. An apparatus, according to claim 27, wherein the means for revising the deposition recipe further comprises means for revising at least one parameter selected from the group consisting of an electroplating bath temperature, a chemical concentration of an electroplating bath, an anode-cathode spacing, an anode power setting and an electroplating deposition time.

36. An apparatus, according to claim 27, further comprising means for depositing a conductive layer above a second semiconductor wafer based upon the revised deposition recipe.

37. An apparatus, comprising:

a deposition tool capable of depositing a conductive layer above a semiconductor wafer;

a deposition tool controller capable of controlling the deposition tool according to a deposition recipe;

a measurement tool capable of measuring at least one thickness of the conductive layer;

a measurement tool controller capable of controlling the measurement tool and outputting thickness data; and

a computer capable of receiving the thickness data from the measurement tool controller, determining whether the thickness data is within a predetermined tolerance, and outputting a revised deposition recipe to the deposition tool controller.

38. An apparatus, according to claim 37, wherein the deposition tool is capable of depositing a copper layer above the semiconductor wafer and the measurement tool is capable of measuring the at least one thickness of the copper layer.

39. An apparatus, according to claim 37, wherein the computer further comprises a database of models for use in revising the deposition recipe.

40. An apparatus, according to claim 37, wherein the computer is capable of calculating deposition bias information and outputting the deposition bias information to the deposition tool controller.

41. An apparatus, according to claim 40, wherein the computer further comprises a database of models for use in calculating deposition bias information.